



# AMTPS Development at NASA

PROJECT MANAGEMENT **ADAM SIDOR (ADAM.T.SIDOR@NASA.GOV)**

## OVERVIEW

Heat shield manufacturing has changed little in the last 60 years. State of the art designs utilize tiled, or block, configurations fabricated in segments and individually bonded to the vehicle structure. Gaps between blocks are then filled. These processes are hands on, labor intensive, and involve long lead times.

## INNOVATION

Additive manufacturing of thermal protection systems (AMTPS) allows a TPS material to be robotically deposited and cured directly on a structure in a monolithic segment, reducing hands-on labor and simplifying integration.

In this work, NASA is developing printable ablative TPS materials for the forebody and backshell of an entry vehicle.

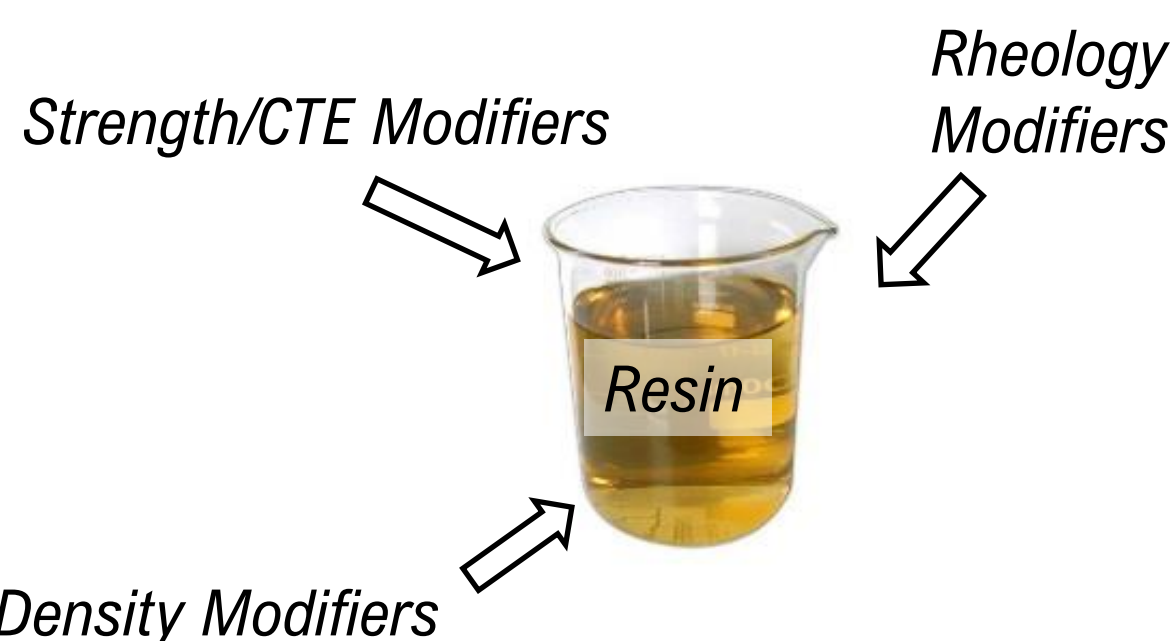
## RESULTS

- Successful orbital flight test of AMTPS heat shield conducted on Cygnus NG-16 in partnership with University of Kentucky

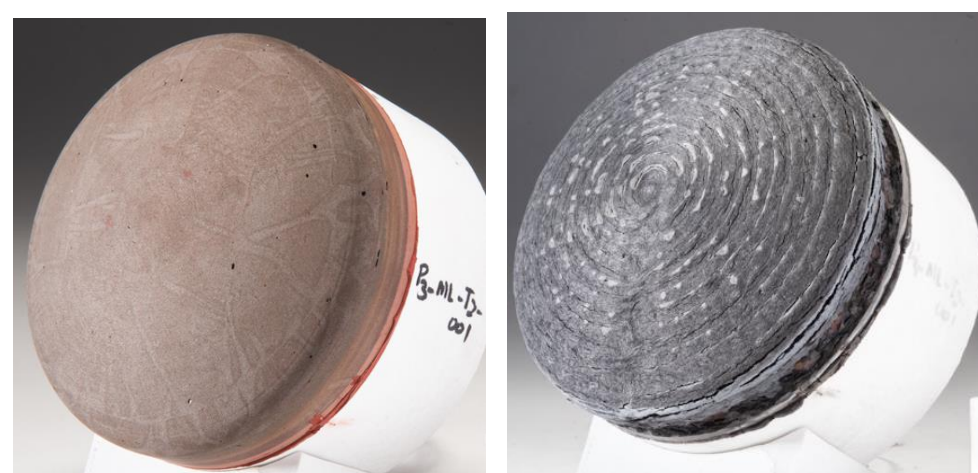


- Development and characterization of a more robust dual layer, printable, phenolic resin-based TPS material

### Material Formulation and Processing



**Arcjet Testing at Ames AHF Facility**  
November 2021

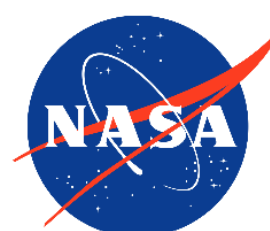


## INFUSION SPACE / EARTH

Suborbital test flight and manufacturing demonstration unit (MDU) will demonstrate viability of the material system and the manufacturing process at scale. Continued maturation will lead to infusion into future missions.

## PARTNERSHIPS / COLLABORATIONS

Development is driven by an internal/external collaboration including NASA Johnson Space Center, NASA Ames Research Center, NASA Langley Research Center, Oak Ridge National Lab (ORNL) Manufacturing Demonstration Facility (MDF), and University of Kentucky.



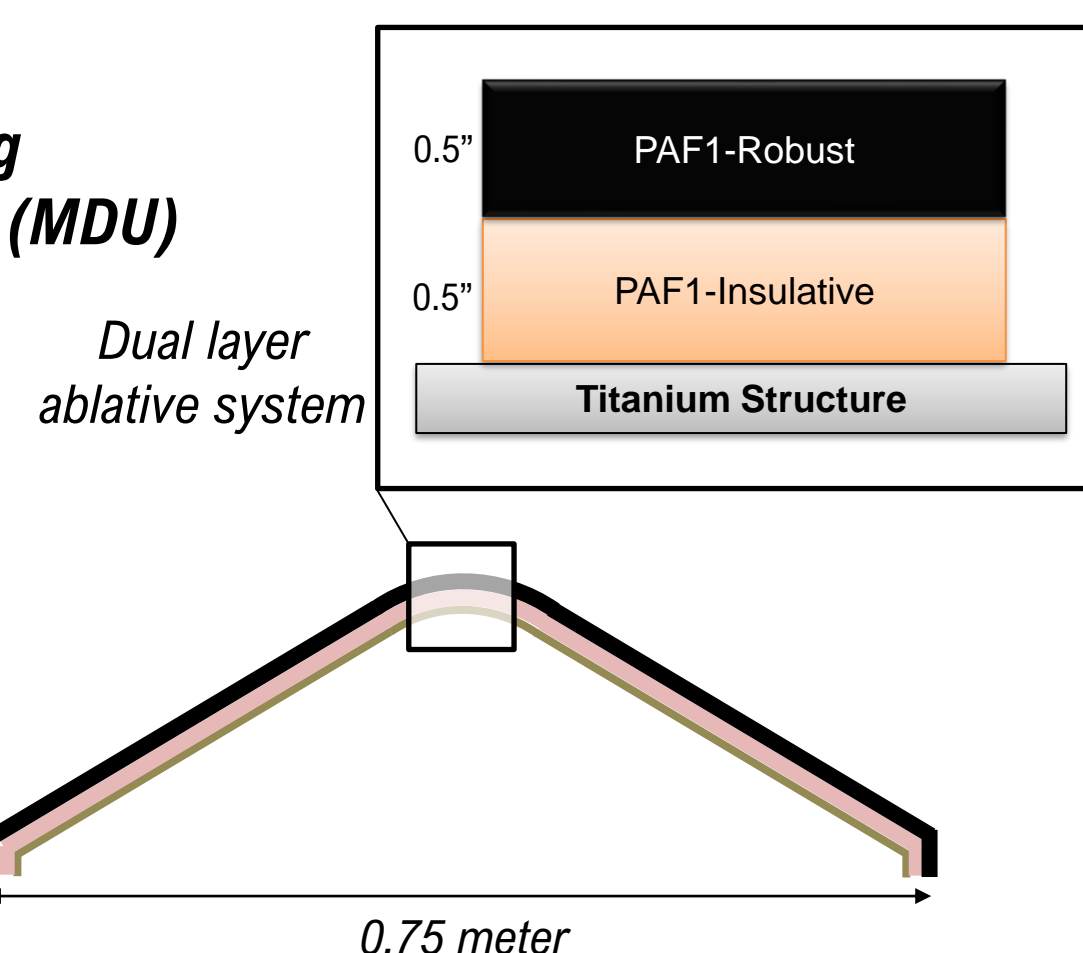
## PAPERS / PRESENTATIONS

Presentation scheduled for National Space & Missiles Materials Symposium (NSMMS) 2022. Additional presentations likely in 2022 and 2023.

## FUTURE WORK

- Manufacturing scale up to be demonstrated in FY22

### Manufacturing Demonstration Unit (MDU)



- Suborbital flight test with instrumented, recoverable AMTPS capsule in FY23 (tentative)

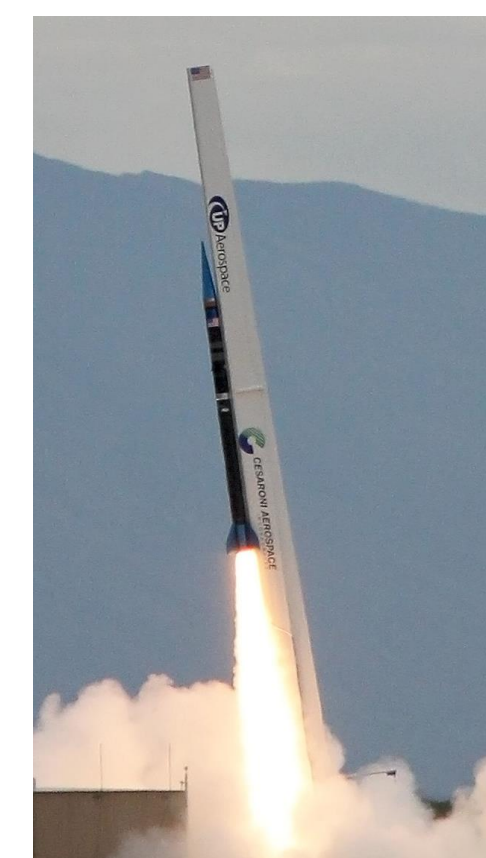
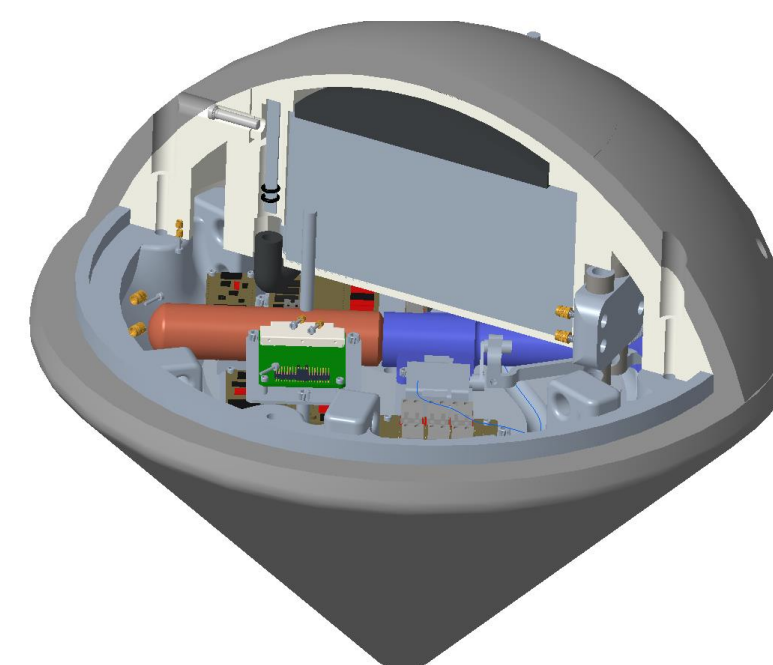


Photo Credit: UpAerospace